

## **SHIFTING BASELINES OF PERCEPTION AND THE VULNERABILITY OF REFERENCE CONDITION AND BIOLOGICAL MONITORING TO CLIMATE CHANGE**

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### **ABSTRACT**

The vulnerability of reference locations to climate change and the need to protect reference locations is recognized as an important issue for the future of bioassessment. Our concept of the natural condition of streams is based on these reference locations, yet we also recognize that they have been subject to industrial anthropogenic influences and disturbance for up to 2 centuries. While reference sites may often be located in remote and less developed regions, they are nevertheless vulnerable to human development and urbanization.

We examined actual and potential reference sites for aquatic biological monitoring, and examined both their regional vulnerability to future climate changes, as well as vulnerability to land use changes. Where possible, we also examined the degree of change from pre-European settlement in North America to current reference condition.

Our results help define the extent of vulnerability of reference locations to urbanization, a landscape-level stressor that is going to increase in the future, and to hydrologic and thermal effects of climate change. We also relate this vulnerability to what is known of historic changes in condition. Interpretation provides insights into how much effort and what approaches should be taken to protect reference locations, as well as the need to monitor long-term fixed “sentinel” locations, and where to locate additional reference or sentinel sites. The shifting baseline of present and future demonstrates that both communication and understanding are immensely improved by measuring biological condition in comparison to pristine, undisturbed condition instead of to present-day reference.

### **KEYWORDS**

Bioassessment, climate change, land use, reference condition